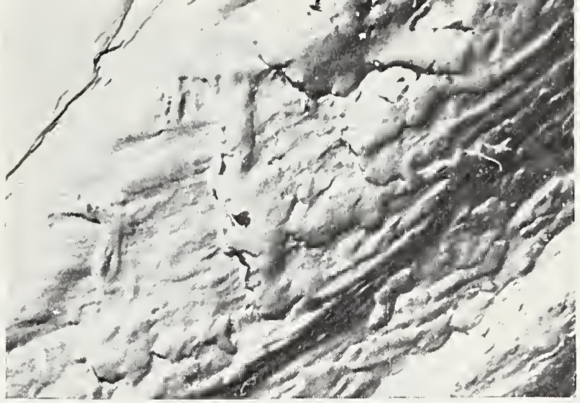
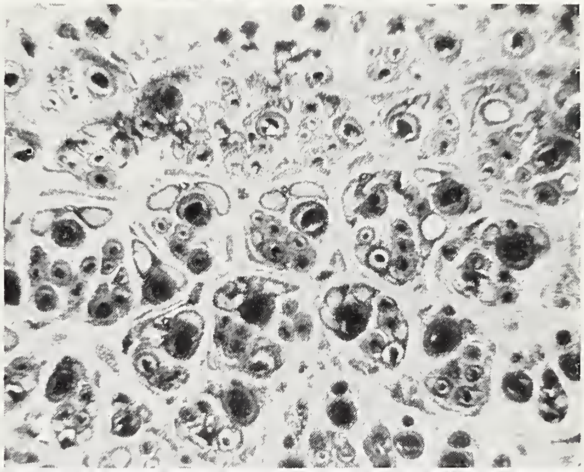
AGRICULTURAL Research

December 1959





U.S. DEPARTMENT OF AGRICULTURE

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Research

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New Approaches

Turning loose a number of vigorous but sexually sterile males will do more to reduce a natural population of animals than simply killing a number of them.

That was hard to believe when ARS entomologist E. F. Knipling advanced the idea some years ago. But now the screwworm pest of livestock has been largely eliminated from the Southeast by this unique biological method. And Knipling suggests that the same principle might be used to control other insects and possibly certain rodents, predators, or other pests.

This deserves further research. The possibilities depend on a number of factors, including mating and dispersal habits. In the case of the screwworm, flies were reared artificially, sterilized with atomic irradiation, and then released by millions to mix and mate with the wild insects. A chemical method of causing male sterility among a natural population would eliminate the cost of rearing and probably be more efficient.

We need to explore this and other new approaches to insect control because the difficulties are so varied and complex that no single method or material can be expected to meet all of them. Scientists see possibilities in diseases, parasites and predators, resistant plants, and cultural controls.

In spite of our troubles with resistance and residues, chemicals are likely to be our main defense against insects for a long time. Here, too, we need new approaches. Possibilities in chemical attractants, growth regulators, and repellents should be exploited. We need to find new insecticides and new ways to use those we have. Perhaps we've overlooked some useful materials by placing too much emphasis on quick kill—a chemical that impairs an insect's ability to feed or reproduce may do the job just as well as a quick-kill chemical, even though the insect doesn't die for some time.

Lacking in all these approaches is knowledge of fundamentals: relation of insects to their environment, population dynamics, host relationships, natural control factors, physiology, nutrition, and the like. Better knowledge of nutrition, for example, could help us on every front from laboratory culture of insects to overcoming resistance to chemicals.

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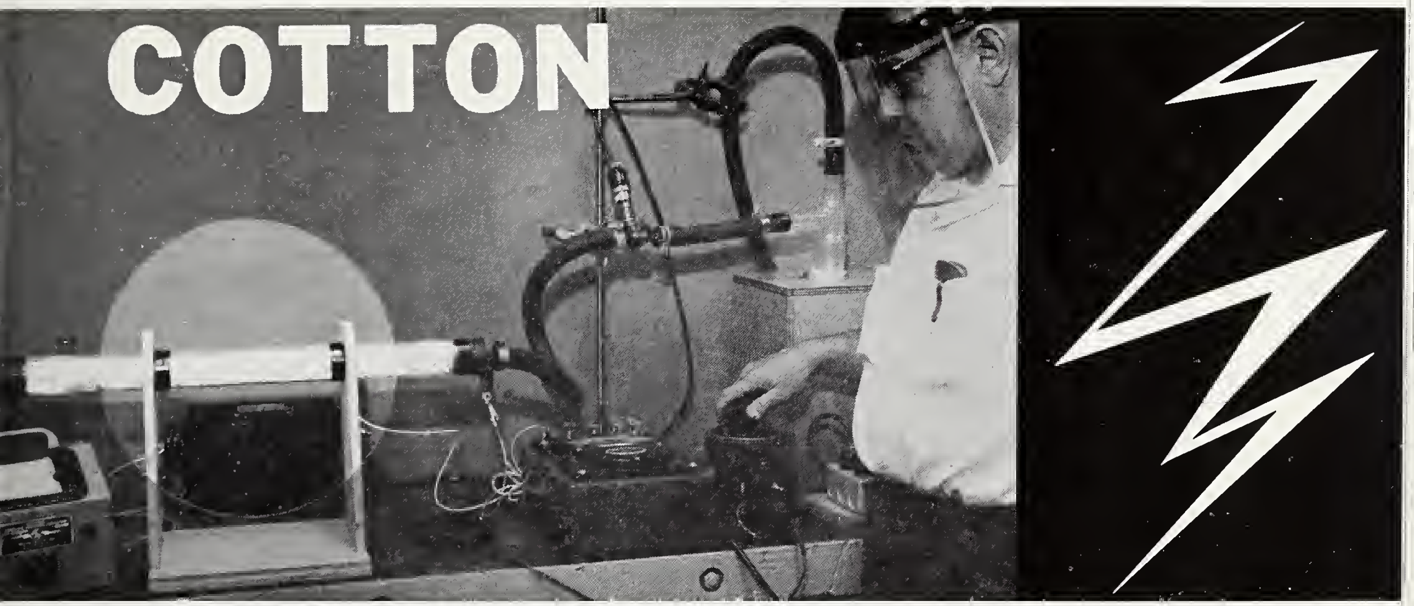
AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

ELECTRICITY CAN CHANGE COTTON



WEAK CURRENT applied to ends of tube causes rarefied air in the tube to glow. Irradiation alters some properties of various plant materials exposed in the tube.

Experimental radiation of seed and fibers has speeded up the seeds' water absorption and germination and raised strength of the yarn in preliminary tests

■ AN ELECTRICAL TREATMENT that makes cottonseed and fiber more water absorbent and cotton yarn stronger is being investigated by USDA in cooperation with the Tennessee Agricultural Experiment Station.

The seed and fiber are treated in a glass chamber through which a weak electrical current is passed. As the current flows through the chamber the gases in the tube glow and act upon the plant material. Scientists call this a glow discharge treatment.

This experimental treatment was developed by ARS agricultural engineer R. B. Stone, Jr., who is continuing research started in 1952 by the inventor of the laboratory device, O. A. Brown. Brown, now retired, is serving as a consultant to USDA (AGR. RES., January 1957, p. 3).

When acid-delinted cottonseed is irradiated in this apparatus and put in water, the seed absorbs water over its entire surface more rapidly than nonirradiated seed. The irradiated seed sinks while nonirradiated floats for several minutes. Nonirradiated cottonseed with fuzz on it floats for more than a day while irradiated seed sinks immediately.

TURN PAGE

ELECTRICITY CAN CHANGE COTTON

(Continued)

The desirability of prompt and uniform germination of cottonseed has long been recognized by cotton growers. A 3-year test is now underway in three States to determine the effects of this electrical treatment on emergence, survival, growth, and yield of cotton. The increased absorption of water by the cottonseed may have a bearing on these factors.

Samples of cotton fiber are no longer soft and pliable after irradiation, but become rough and stiff. It is extremely difficult to extract single fibers or even groups of fiber from a treated sample. Examination of the fiber with an electron microscope shows that the normal wax coating is pierced in many places and that the fiber surface is roughened. Analysis of the treated fiber shows the percentage of wax and the melting point of the wax are lowered. It is believed that these factors increase the absorbency of the fiber.

Yarn strength is increased

The roughened surface of the fiber influences the breaking strength of cotton yarn because the fibers do not pull apart easily. A sample of treated cotton yarn had a breaking strength of 1,697 grams compared with 1,382 for untreated yarn. This is more than a 20 percent improvement in strength. Research is underway to compare irradiated yarn with chemically treated commercial yarn.

Although still in the laboratory stage, the glow discharge treatment holds promise for killing weed seeds mixed with crop seeds, for higher and more uniform germination of many crop seeds, and for reducing cooking time of dry plant materials.

Due to differences in irradiation tolerance of seeds, wild garlic can be killed when in mixture with barley seed with only 20 percent injury to barley. Possibility of applying this glow-discharge treatment to other seeds is being investigated.

Early experiments with this apparatus showed that corn seeds exposed to electrical radiation germinated somewhat faster and more uniformly than unexposed seed. However, field trials did not show that yields were significantly increased.

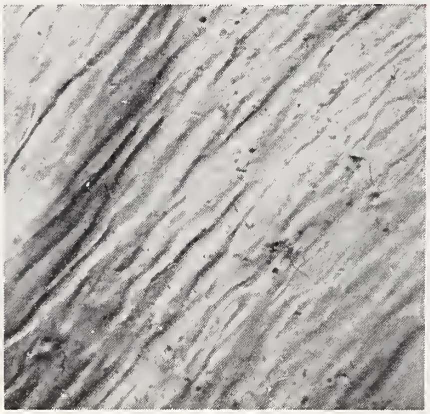
Species respond differently

In field tests, germination of Purple Top turnipseed was fully inhibited, whereas red clover and smooth mustard were apparently unharmed.

Treatment method is described

After material to be treated is placed in a glass chamber 2 feet long and 2 inches in diameter, the air is evacuated to a pressure of less than 1 percent that of normal atmosphere. About 1,000 volts is applied to electrodes at ends of the tube and a current of 10 to 50 milliamperes is allowed to pass through the circuit for a few seconds to 10 minutes, depending on the amount of irradiation desired. The exact manner of action by this irradiation on the plant material has not been determined. ☆

UNTREATED



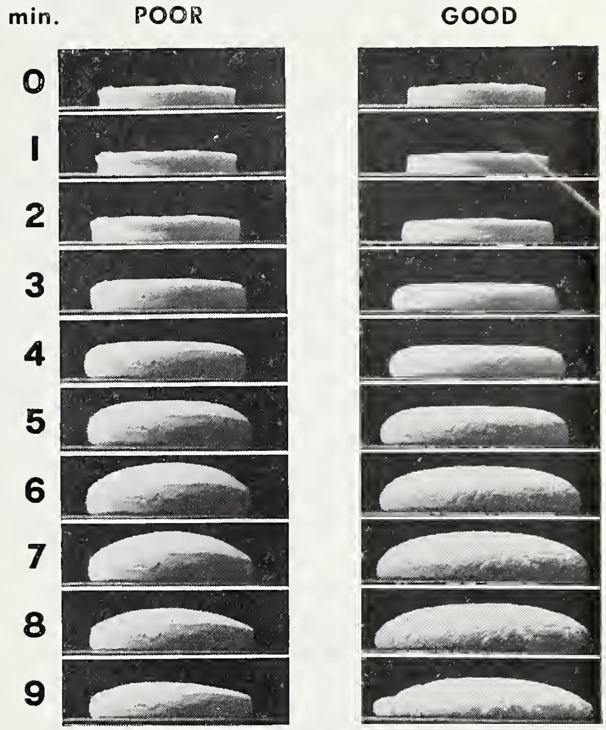
Untreated cotton fiber, which is seen above greatly magnified, has a smooth surface characteristic of this kind of lint. All seeds below have been in water for same period. Untreated ones at left absorbed little water, but treated ones at right became saturated. Electrical treatment gives seeds a quick start in germinating.

TREATED

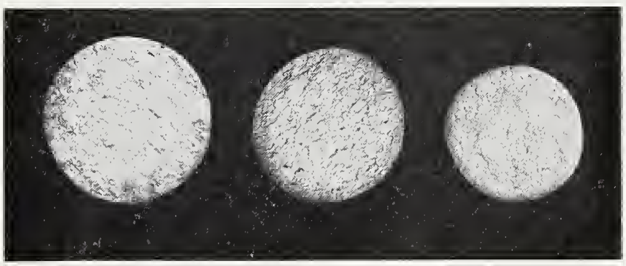
Treated fiber in the above photomicrograph shows a decided roughening of the surface as a result of the radiation. Fibers like this cling together better and produce a stronger yarn. Water puddled on surface of untreated cotton, below left, while the radiated lint at right saturated readily. That's desirable for an absorbent cotton.

Why Does The Cookie Test Work?

Our understanding of dough's behavior in baking may lead to better breeding guides for soft wheats



DIFFERENCE in properties of poor and good quality flours shows in time-lapse pictures taken during baking of test cookies. Smaller spread of cookie made from poor-quality flour is related to earlier increase in viscosity; spreading stopped after 5 to 6 minutes.



VARYING AMOUNT of crude starch tailings in a test flour showed effect of tailings on cookie spread. Left. cookie without tailings; center, with normal amount; right, with double amount.

■ Soft wheat flour that bakes into large, flaky sugarsnap cookies gets a good quality rating for making pastries, biscuits, crackers, and pretzels as well as cookies. In fact, the sugarsnap-cookie test—a measurement of cookie spread—is the standard first step in evaluating the quality of a soft wheat.

USDA scientists at the Soft Wheat Quality Laboratory, Wooster, Ohio, who check milling and baking properties of newly developed soft wheats, are trying to find what makes flour pass or fail the cookie test. They're working on methods of determining the actual physical and chemical basis of baking quality to give a better guide to wheat breeders in developing new wheats.

Experiments by ARS chemist W. T. Yamazaki point to the behavior of flour components in the presence of water as a main factor in cookie quality.

Yamazaki first found a correlation between cookie spread and the hydration capacity of flour. Flours that held little water baked large, flaky cookies, while flours with high water retention made hard cookies that spread little during baking.

After separating flour into three basic fractions—gluten, prime starch, and crude starch tailings—Yamazaki showed the crude starch tailings had the highest hydration capacity. And this component reduced cookie spread in relation to the amount of starch tailings in the flour. In baking tests, reconstituted flour without tailings produced cookies with the largest diameters.

Absorptive substances reduce cookie spread

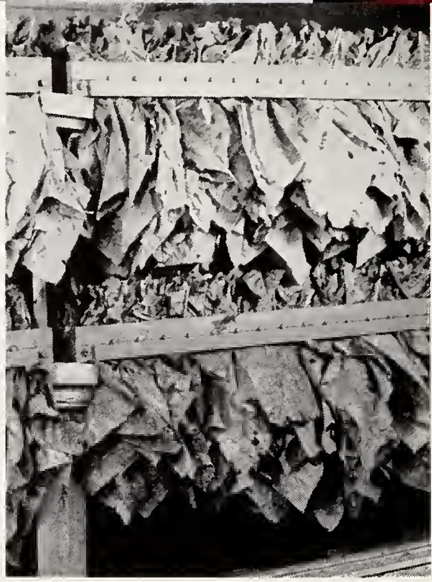
Addition to test flour of other highly absorptive substances such as agar and gelatin also reduced cookie spread. So the physical nature of the tailings, rather than their chemical composition, appeared to be responsible for the adverse effect on cookie spread.

In another experiment, the rate of increase in viscosity of cookie doughs with increasing temperature correlated with cookie quality. Test flours from four wheat classes—soft white, soft red, semihard red, and hard red—had cookie-quality ratings of good, fair, poor, and very poor, respectively, by conventional tests.

Tested for rate of change in viscosity under heat, doughs from the soft white wheat flour remained plastic the longest and required the highest temperatures for setting. But doughs from hard wheats increased in viscosity relatively early in the heating. And cookies made from soft white wheat flour spread for about 9 minutes during baking, compared with 5 to 6 minutes for cookies made from hard red wheat. ☆

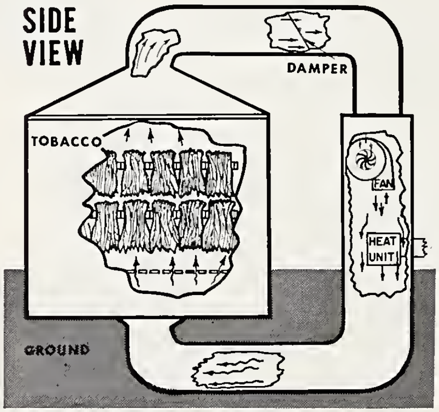
BRIGHT-LEAF CAN BE CURED IN BULK

New method saves labor, barn space, fuel, and fire hazards, gives good product



CHAMBER tested two layers deep in 1958, held three layers in 1959 and cured as much leaf as conventional barns six times larger.

LEAVES are neatly laid into frame and speared onto rack in a single operation. This speeds up the job and frees workers for other duties at harvest rush period.



A FAMILIAR SCENE in flue-cured tobacco areas of the South may disappear in the next few years when the North Carolina Agricultural Experiment Station and USDA perfect a new way to cure bright-leaf tobacco.

The method is bulk curing—curing whole or shredded leaves in a tight pack. It will eliminate about three-fourths of the hand labor now necessary in curing tobacco, including the familiar stringing sessions seen during the summer months in the flue-cured tobacco areas.

Bulk-curing will also (1) require less space—about one-sixth as much as a conventional curing barn, (2) produce high-quality tobacco by improved regulation of temperature and drying rates, (3) virtually eliminate all fire hazards, since the heating system is outside the building, and (4) require less fuel because the heated air is recirculated.

In 1955, feasibility of bulk curing was shown in a rectangular chamber developed by agricultural engineers W. H. Johnson and F. J. Hassler, of the State station, and W. H. Henson, Jr., of ARS. Further refinements were made in 1956 by employing three cylindrical bulk-curing chambers. These round chambers held 200 pounds of uncured leaf tobacco.

In 1957, six cabinet-type chambers were used. These contributed to faster, easier loading and allowed much greater uniformity in packing the tobacco. Each chamber held in a vertical position 160 pounds of closely packed tobacco leaves in 2 racks. Tobacco cured in these chambers was comparable to conventionally cured tobacco in quality, aroma, flavor, and nicotine and sugar content.

Encouraged by these results, the engineers set up a pilot operation in 1958 at Oxford, N.C. Emphasis was placed on simplifying loading and unloading of tobacco, adapting air-flow and temperature schedules to enhance the quality of the cured tobacco, and obtaining maximum operational efficiencies. One chamber, 10 by 12 by 6½ feet, held as much tobacco as a conventional curing barn 16 by 16 by 20 feet. Here, too, quality was high. These conclusions are based on evaluations by commercial tobacco companies who conducted smoking tests.

The chambers were tested with only two layers of tobacco in 1958, but with three layers in the same 6½-foot height in 1959. The engineers want to determine the most desirable capacity for a chamber.

During these same years, tests were also conducted on bulk curing green shredded tobacco. Practically all hand labor, from harvesting to curing, can be eliminated if the tobacco can be shredded during harvesting. Shredded tobacco when cured had excellent color but objectionable aroma. In addition, the sugar and nicotine content were significantly lower—an undesirable result. Consequently, research is underway to improve curability of shredded leaf.

Commercial tobacco companies and farmers are enthusiastic about prospects of bulk curing. An on-the-farm tryout is planned. If it succeeds, we will be a step closer to mechanization of bright-leaf tobacco farming. ☆

New Home for Grain Treasures

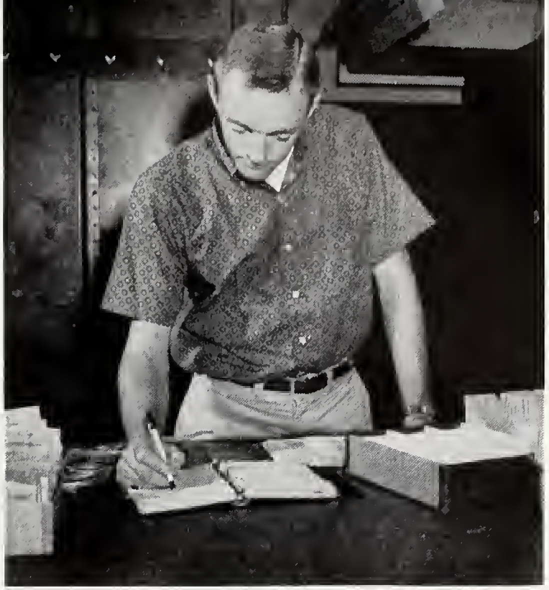
Germplasm of small grains from all over the world is carefully maintained for breeding

■ THE WORLD COLLECTION of Small Grains, USDA's genetic pool for grain breeders, is in a new laboratory at the Agricultural Research Center, Beltsville, Md.

The collection—comprising old, new, foreign, domestic, and experimental lines of wheat, barley, oats, rye, buckwheat, and other grains—is now housed in its own building, where controlled temperature and humidity can better preserve viability of this valuable germplasm. It's hoped seed will last 10 years, instead of 5, before replenishing is necessary. That's no small job when 30,000 different varieties are concerned.

The small-grains staff, in cooperation with State, Federal, and foreign experiment stations, collects and distributes working stocks of grain for evaluation and breeding. Seed is obtained from plant explorers, breeders, world expositions, and exchanges with foreign governments. Over 91,000 seedlots were distributed here and abroad in 1958.

In addition to the working stocks housed at Beltsville, well-documented material of all important breeding lines is being assigned to the National Seed Storage Laboratory at Fort Collins, Colo. Acceptance by the seed-storage laboratory insures against the loss of valuable germplasm from working collections. ☆



LABORATORY STAFF records receipt of wheat seeds from Russia, makes up packets. Seeds will be sent to Mesa, Ariz., to be screened for weeds and diseases and increased for working stocks.

SEED DIVIDER fills up to 16 packets at a time, speeds making up of sets of the seeds (barley here) for testing as to disease resistance and other characters. Cooperators send test evaluations back to laboratory. Records of all tests are kept on file.

ANNUAL INVENTORY is taken of collection to insure working stocks are always available. Seedstocks of oats and barley are replenished at Aberdeen, Idaho, experiment station; wheat, rye, and buckwheat at Mesa.

TOMATO paste in the dish at left has been preconcentrated. A foaming agent is then added and the mixture whipped to produce tomato foam seen in dish at right.

DRYING FOODS THE FOAM-MAT WAY

Preliminary tests in whipping food concentrates into a foam and drying it have produced a highly porous powder that remains quite stable but readily reconstitutes in cold water

■ USDA's SEARCH FOR BETTER WAYS to make tomato-juice powder gave us a drying method that may eventually apply to other foods as well.

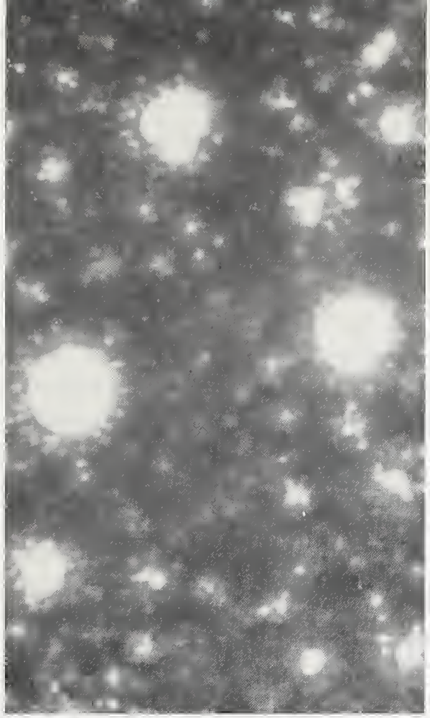
The new method—developed at the ARS Western utilization division, Albany, Calif.—is called "foam-mat drying." It consists of whipping the liquid tomato-juice concentrate into a foam, spreading the foam on a belt or tray, drying it in a stream of warm air, and crushing it into powder form. Tomato juice powder made by this method has good initial color and flavor, and can be reconstituted easily with water, even ice water. Storage tests of the product haven't been completed.

Foam-mat drying is one of several methods developed by USDA to produce high-quality instantly reconstituted food products (AGR. RES., Sept. 1954, p. 13; Sept. 1956, p. 11; April 1958 p. 3).

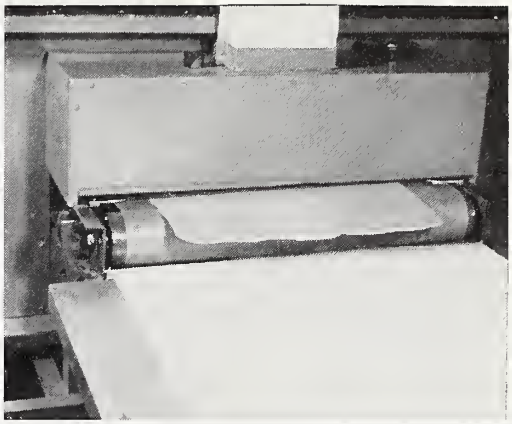
Success of the new drying technique rests largely on producing a stable foam by adding a suitable emulsifier, whipping to incorporate air or inert gas, and drying under controlled conditions. The fine structure of the dried foam remains intact, even when it's compressed into pellets to achieve high bulk density. Foam-mat dried tomato powder shows less tendency to cake than that dried by other methods.

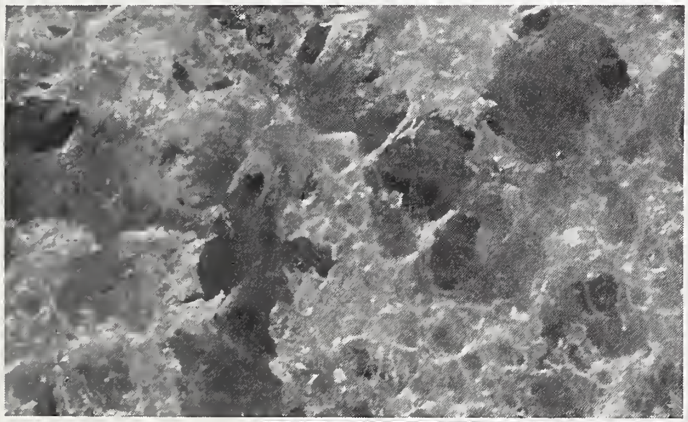
In addition to developing this technique for tomato juice powder, utilization scientists have also made preliminary tests to determine possible use of the new method for making fruit powders. So far, powders of good initial flavor and color have been made from prune whip, lemonade, and apricot, pineapple, apple, grape, and orange juices.

Meanwhile, research is continuing at the Western division on further processing details, on quality and stability evaluations, and on problems concerning equipment needs for commercial application. ☆

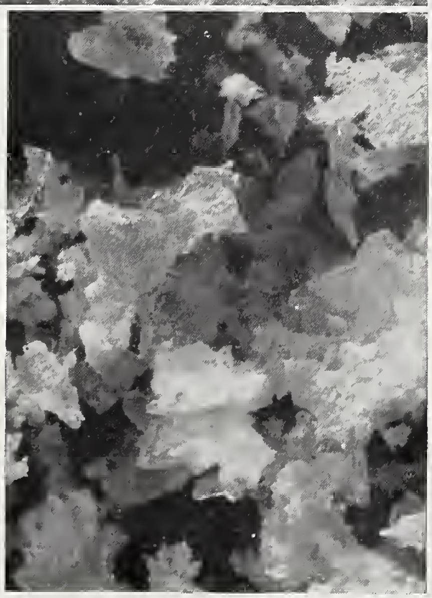


ENLARGED view of liquid tomato foam at left shows light, bubbly appearance. Foam is generated by whipping mixture in air or inert gas. Foam is then spread in a uniform layer upon drying belt (below) and can be removed intact from it. Drying time depends on air temperature and thickness of the foam layer being dried.





SPONGE-LIKE look of dried tomato foam mat shows in above photo. Powder reconstitutes to give a fresh-tasting and full-flavored juice that has a natural color.



FOAM MAT pulverizes easily into a powder (above) that will reconstitute in cold water with only a minimum of stirring. The delicate crystalline structure of tomato foam powder shows clearly in picture at left. The fine foam structure resulting from foam-mat drying is unique in its high degree of porosity.

Breeders and Chemists look at
A MILK PROTEIN

Molecule's behavior and control by genes create interest

■ THE INTERESTING NATURE of the milk protein beta-lactoglobulin is being explored by USDA research.

We want to know more about this major whey component, which exists in two types and is completely controlled by breeding. In fact, it's the first chemical constituent of milk found that can be thus controlled. USDA studies have confirmed these findings by British researchers.

The British separated beta-lactoglobulin into two fractions (beta-A and beta-B) by passing an electric current through the protein solution in a process called paper electrophoresis. It was found that the beta compound produced by a given cow is either the A type, the B type, or a mixture of both types. Through several generations of cattle ran a consistent beta trail from mother through daughter to granddaughters and through son to granddaughters.

Type followed family lines

The genetic makeup of sires for the character was reflected by the milk tests of their daughters.

Data showed a clearcut pattern for prediction of the beta type in offspring from a knowledge of parental types. Two type-A parents invariably have only type-A offspring; two type B's only B offspring; and an A paired with a B, only AB offspring. Prediction was only possible on a probability basis when either or both parents were type AB. The overall pattern meant only one thing: that the beta character is transmissible genetically through a single pair of genes—one from each parent.

Inheritance factor is studied

Two teams of ARS scientists, dairy husbandmen C. A. Kiddy and R. D. Plowman, of the Agricultural Research Center, Beltsville, Md., and chemists R. Townend and S. N. Timasheff of the Eastern utilization division, Philadelphia, traced the A and B genes through several generations of the Beltsville Holstein herd by electrophoretic analysis of the milk beta-lactoglobulin.

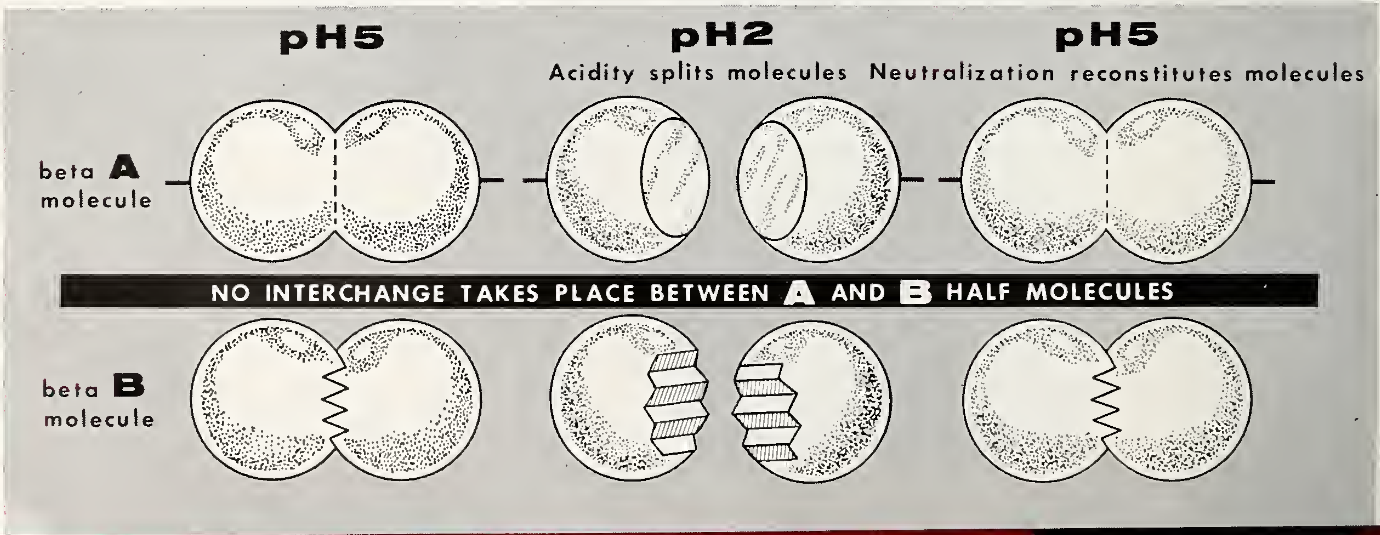
When testing beta under mildly acidic conditions, Townend and Timasheff noted that the two proteins could be distinguished electrophoretically because the A type has two more negative electric charges than the B. From this they assumed (and others later confirmed) the existence of two more carboxyl groups on the A molecule. The chemists further discovered that in strongly acidic solutions, the molecules split into halves, but on neutralization, the halves come together again.

Research obstacle is overcome

Unfortunately, under strongly acidic conditions, the electric charges are lost, so the A half molecules can't be separated from the B half molecules electrophoretically. Nor is their slight difference in molecular weight, due to the A molecule's extra carboxyl groups, sufficient basis for their separation.

Still hoping to learn about structure and behavior of the half molecules, the chemists sought information through study of the recombined halves. They wanted to know how the extra carboxyls are attached—each to a different half of molecule A or both to one half—and whether halves of the A and B molecules interchange in being reconstituted.

If one extra carboxyl was attached to each half of molecule A, an ex-



change between A and B halves would produce some intermediate forms with a single extra charge. But when Townend and Timasheff acidified and then neutralized a mixture of A and B types, all of the molecules reconstituted as either type A or type B—without intermediates. This, of course, might mean that an interchange occurred, but that the extra carboxyls are both attached to a single half molecule of A.

To check out this possibility, the dairy husbandmen and chemists used radioactive tracers. One of the Beltsville cows which produced only beta-A was injected with a carbon-14-labeled amino acid (valine). Within a few hours this cow was producing radioactive milk. The chemists isolated beta-A from this milk and mixed the tagged molecules with untagged molecules of beta-B. They acidified and neutralized the mixture, then separated the A and B molecules electrophoretically. They found that no radioactivity had passed from A to B in the process.

Molecules don't swap halves

Here was the chemical proof the scientists were looking for, that no hybrids of beta-A and beta-B are formed. From this it follows that the half molecules of A must be linked together in one way and those of B in quite another way. It also indicates that the halves into which the molecules split are structurally identical, and that when they are separated and then recombined there may be interchange within, but not between, half molecules of beta-A and beta-B.

Only time will tell whether this structural behavior of beta-lactoglobulin has any importance to the quality of milk. Its clarification, however, allows scientists to put into place one more piece of the jigsaw puzzle that may someday show completely the way in which genes act to control protein synthesis. ☆

VE Has Been ERADICATED

■ Vesicular exanthema (VE), a serious swine disease that once was a nationwide threat, has been eradicated from our country. Secretary of Agriculture Ezra Taft Benson declared that the emergency was over on October 22 after a 3-year lapse since the disease was last reported. Insofar as USDA animal-disease-eradication officials know, the disease does not now exist anywhere in the world.

This virus disease became a problem in 1952, when it escaped from California where it had been confined for more than 20 years. In 6 weeks it was in 18 States, and in a year, 43 States. Spread came primarily through direct contact with infected swine, mechanical carriers, and feeding of raw garbage containing infected raw pork scraps.

The Secretary of Agriculture declared a state of emergency in August 1952, and a cooperative nationwide eradication effort was immediately started by USDA and the 48 States. The eradication plan called for (1) inspection, (2) quarantine, (3) prompt disposal of infected and exposed swine, (4) thorough disinfection of all contaminated areas, and (5) laws forbidding the feeding of raw garbage to swine.

Because raw garbage proved a major source of infection and spread, great emphasis was placed on enlisting State controls requiring that all garbage be cooked before feeding to swine. Ultimately, all the 48 States and Hawaii passed such laws or regulations.

Cooperative State-Federal inspection of farms that feed garbage to swine will be continued to insure that all garbage is cooked. Federal inspectors at public stockyards will also continue to watch for VE.

The campaign against this disease has given us an unexpected dividend—better control and prevention of other swine diseases, including trichinosis, long an enemy of man as well as swine, and hog cholera, tuberculosis, and foot-and-mouth disease. Cooking raw garbage kills many disease organisms. For example, trichinosis among slaughtered hogs in the Boston area declined by four-fifths in limited samplings since Massachusetts enacted the law requiring cooking of garbage.

VE causes weight losses in mature hogs, slower gains in feeder pigs, and sometimes death in suckling pigs. Symptoms are like those of foot-and-mouth disease and the less serious vesicular stomatitis. In all three, blisters develop on the feet and snout of an affected animal and rupture rapidly, leaving a raw, eroded surface. Blisters may also form on the lips, tongue, and other parts of the mouth cavity lining. Since symptoms of all three diseases are so similar, laboratory tests are necessary to determine which of the diseases an animal has.

Research on the VE virus will be transferred to the Plum Island Animal Disease Laboratory near Long Island, where research is done on foot-and-mouth disease. This laboratory is responsible for all research on exotic animal diseases—those foreign to this country.

Success against this disease is a tribute to State and Federal animal-disease-eradication officials, who cooperated closely in containing and finally eradicating the disease, and to the research workers who provided the vital information on the disease. ☆

HOW WOOL BEGINS

Nature of lamb's fleece is determined in the developing follicles of the fetal skin

■ SOFT FLEECE of fine-wooled sheep doesn't seem to have much in common with the coarse hair of the goat, the quills of the porcupine, or even a pig's bristles.

But common to them all is their general skin structure and the way types of hair fibers are formed.

Experimental work on sheep and goats at USDA's Agricultural Research Center, Beltsville, Md., is helping to fill in gaps in our knowledge of skin structure and function, thus helping to lay the groundwork for practical plans to improve production of animal fibers.

We know this much:

The skin consists of two major layers—the *epidermis* and the underlying *dermis* or skin proper. The outermost layer of the epidermis consists of dead keratinized cells continuously sloughing off and being replaced by new ones from the underlying "germinal" layer. This living, highly active layer of the epidermis is especially important because of its inherent capacity for continuous cell division and differentiation.

Germinal cells not only replenish the epidermis, but also provide added cells for skin expansion in the fetus and later in the growing animal. Germinal cells in the fetus also have the unique capacity to initiate follicles—the sac-like structures that later produce the wool, hair, and mohair fibers to cover the animal.

The dermis is made up of nerve fibers, connective tissue supporting the epidermis, and blood vessels supplying nutrition to the skin of the animal.

How do follicles develop and grow? A comprehensive study of skin by ARS biologist L. Margolena Hansen at Beltsville has provided part of the answer.

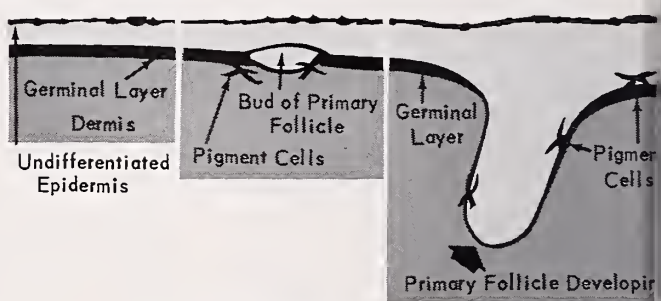
The follicles appear at a certain stage of fetal development—just when depends on the animal—and in a definite order. The first hint of their appearance is the formation of follicular buds—localized groups of cells developed from the germinal layer. They're recognizable at this early stage by little more than an orientation differing from that of their neighboring cells. As the buds differentiate and grow, they force their way into the dermis. By the 70th day of fetal life, according to Beltsville studies, the earliest follicular buds are found over the entire skin of Karakul sheep and the common American and Toggenburg goats.

The next buds develop within a week or two, one on each side of the now centrally located follicle. Thus, a cluster of three larger or *primary* follicles is formed. To complete the group, smaller or *secondary* follicles then develop nearby in one, two, or more spurts, depending on the species and breed. Bands of connective tissue outline each follicular group and separate one group from another.

Follicle differences are described

Again, depending on species and breed, the primary follicles may take advantage of their earlier start and grow to several times the size of the secondary follicles. In the fine-wool breeds of sheep, the size difference between the primary and secondary follicles is less pronounced than in the coarse-wool types.

The Way Follicle



UP TO ABOUT 50 days of fetal life in Karakul sheep, the epidermis and dermis remain relatively undifferentiated (A). But within the fallawing twa manths (B), cells begin to graup tagether in the germinal layer ta farm the fallicular bud. Pigment cells shaw up early in fetal develapment, assuming various spider-like shapes. At abaut 80 days (C), bud has already develaped inta partly farmed follicle. And at abaut 100 days (D), bud has pushed well inta the dermis and acquired accessary structures, the sweat and ail glands. At araund 120 days af fetal life (E), primary fallicle is fully develaped and fiber has pierced skin. Secandary fallicles mature later in the fetal life of sheep, but in same breeds af gaats, nat until shartly after birth. Fallicles and fibers develap in gaat fetuses in the same general way as in sheep fetuses, the studies at Beltsville, Md., shaw.

Primary follicles can be recognized also by the presence of sweat and sebaceous glands, although the latter may sometimes be found connected with a portion of the secondary follicles in some breeds of sheep and goats.

Fiber emerges by 120th day of fetal life

A follicle is considered mature when it has developed a keratinized or hard fiber. The primary follicles of the sheep or goats studied mature about a week after their direct blood supply has been established. This occurs between 90 and 100 days of fetal life. Further growth of the fiber causes it to pierce the skin sometime before the 120th day of uterine life.

Maturation of secondary follicles in the Karakul sheep is close to completion a few weeks before the end of the 5-month gestation period. But the process is generally slower in the goat, where the later secondary follicles remain unkeratinized until a month after birth.

Except for periods of shedding, when an old fiber may still persist next to the new one, one follicle contains but one fiber. This important fact enables scientists to assess the fiber density per unit area of an animal. By counting the number of follicles in a given area, it's thus possible to predict the potential fiber population of an animal at one or a few months of age. Once the follicular groups are established, no new ones will appear throughout life, unless a new skin is developed as in the case of wound healing.

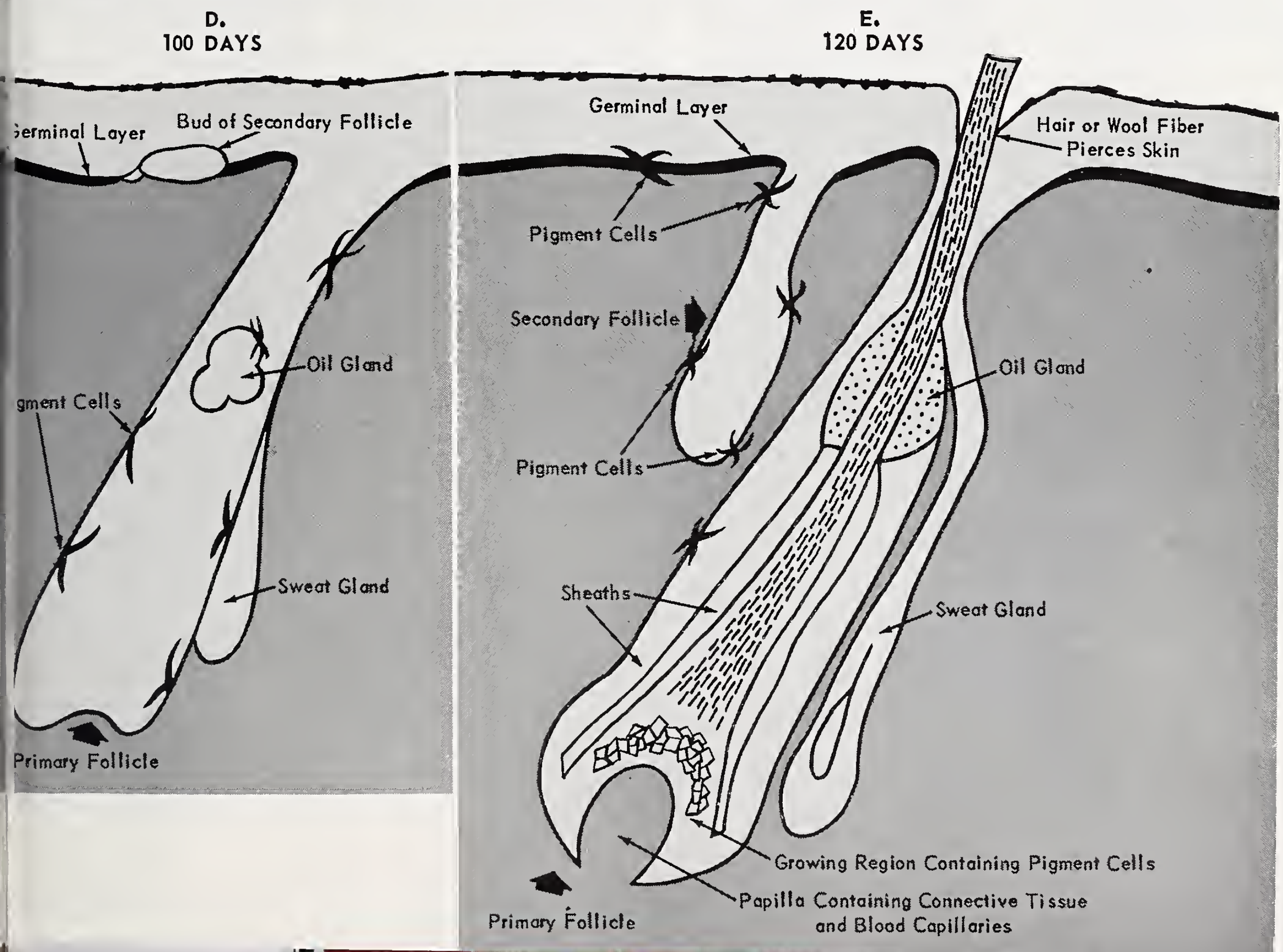
Density then depends on the proportion of the secondary follicles within a group, and the proximity of groups themselves. Differences in secondary-primary ratios between species and breeds are quite striking. Thus, goats and sheep with coarser pelts or fleeces may have only 9 to 14 secondary follicles per 3 primary ones. On the other hand, some of the fine-wooled sheep have as many as 25 or even 50 or more secondary follicles per 3 primary follicles. A decrease in the number of groups per unit of skin area generally follows increase in body size as an animal grows.

Practical use for new facts is visualized

Beltsville scientists feel it's possible to speculate along these lines: Denser fleeces originate with fetuses with large body surfaces at the critical prenatal period when

TURN PAGE

evelop and Produce Fibers in Skin of a Sheep Fetus

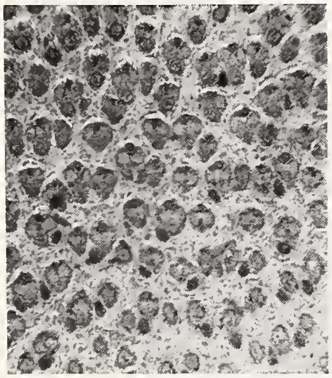


follicles are being initiated. Thus, an attempt to speed up fetal growth at this critical period by feeding or injecting pregnant ewes with hormones or growth substances may hold possibilities.

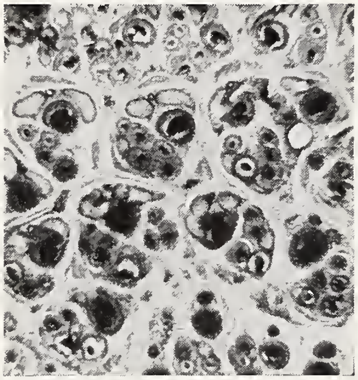
Some of the current studies at Beltsville deal with the effect of environmental factors on the skins, and with fiber development in Rambouillet sheep and Angora goats. Climate, or geographical location, and season, pasture, and diet are some of the factors being investigated for their possible effects on fiber growth.

Follicles grow faster in summer months

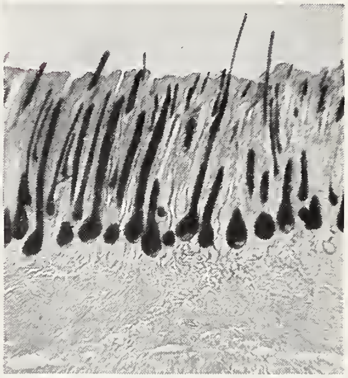
Counts of cell divisions in the growing follicles of Merino and Hampshire sheep and Toggenburg goats have been carried out at Beltsville during all seasons of the year. Biologist Hansen has found figures to be higher during the warmer months than in late fall and winter. This apparently indicates faster growth during summer. ☆



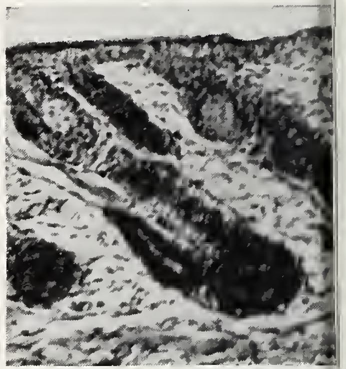
FOLLICLE groups are not yet clear in view looking down on 100-day-old Karakul sheep fetus.



GROUPS of primary, secondary follicles are clearly seen in fetus of 145 days. Connective tissue fibers separate groups.



FIVE days after birth, cross-section of lamb skin shows fibers clearly. They're well developed at birth.



GOAT FETUS of 95 days has well defined primary and secondary follicles, as seen in this cross-section.

Hog-cholera Control Has Been Pilot-tested

■ FEDERAL-STATE hog cholera control experiments of pilot-test dimensions, underway in Florida, have shown that 92.2 percent of the pigs and 89 percent of the vaccinated herds in the test area are adequately protected against the disease.

The tests are being made by USDA scientists with the cooperation of the Florida State Livestock Board.

About 60,000 swine on 1,500 individual farms are being used in the experiment. The farms in this study are located within a test area centered around the ARS Hog Cholera Research Station at Live Oak, Fla.

About 60 percent of the pigs are being vaccinated with modified live virus vaccines and anti-hog-cholera serum. Representative samples of all vaccinated animals used in the experiment are tested for cholera immunity at the Live Oak Station.

From April 1957, when the experiment started, until the present there have been 76 suspected cases reported. Thirty-seven of these suspects were tested by inoculation, which resulted in 12 positive and 25 negative tests for hog cholera virus.

Disease sources are concern

Study of suspected cases showed that, in most instances, the affected hogs came from public markets in the test area. Therefore, the Florida Livestock Board resolved that, as of July 1, 1958, all hogs passing through public markets in the test area, and not destined for immediate slaughter, be vaccinated before being transported to a farm. But despite this vaccination, there are still outbreaks of hog cholera. That station's investigations indicate that some pigs vaccinated at public markets are affected with hog cholera at the time of sale because most of the 12 positive cases occurred in herds making such purchases.

The experiment is being continued to see if complete eradication of cholera within the test area can be accomplished under these conditions. ☆

Rotation is promising

A means of managing a rotation of Coastal Bermudagrass and corn so the grass will re-establish itself without the expense of reseeding has been developed by USDA and the Georgia Agricultural Experiment Station.

This was accomplished with a rotation including 3 years of Coastal Bermudagrass and 1 year of corn. After tillage and the planting of corn, the grass begins to recover, forming a good sod before harvest without interfering with corn production. Sod thus protects the soil for all but 3 months of the 4-year rotation. In many areas, the soil is fallow and erodible between corn plantings.

Also, a good hay crop can be harvested the first year after corn. And during two hurricanes, corn growing in rotation with Coastal Bermuda was held firm by the heavy sod, while other corn plots were flattened.

Coastal Bermudagrass is the only desirable grass now known to work in the rotation plan, thus limiting the method to the Southeastern States.

Nematode in new area

The soybean cyst nematode was found in Illinois this summer for the first time, USDA regulatory officials report. It occurred in the south near the Ohio River. Other new infestations were found across the river in Kentucky and in Missouri.

The nematode has been known in some areas of the United States since 1954, and surveys made last summer revealed that more than 32,000 acres of soybeans in 26 counties in Arkansas, Kentucky, Mississippi, Missouri, North Carolina, Tennessee, and Virginia were affected. Some soybean growers lost an entire crop.

The Federal quarantine was first imposed in 1957 to prevent spread of the pest. Work is underway to perfect a method of eradicating the nematode, and plant breeders are developing soybean varieties that combine resistance with acceptable agronomic characters. Meanwhile, rotation on a 3-year to 5-year basis is an effective and practical control.

Use for brackish water

Many crops can be saved during droughts by irrigation with brackish water in coastal areas where the sea has flooded into surface water sources or infiltrated wells. Brackish water is usable for crop production when it's a tenth to an eighth as salty as sea water, USDA research shows.

Virginia studies show an accumulation of salts in the top 6 to 12 inches of soil where brackish water has been used, but the following winter's rains usually wash them out.

Asparagus, spinach, garden beets, barley, sugar beets, and cotton are salt tolerant—tomatoes, sweet corn, lettuce, onions, rye, wheat, oats, soybeans and the cabbages fairly so.

Growers faced with using brackish water should make arrangements for analysis of the salt content through their county agricultural agents or Soil Conservation Service personnel, to insure safe and effective use.

Bermudagrass winterkill

High nitrogen levels without adequate potash will, over a period of years, increase the hazards of winterkill of Coastal Bermudagrass, USDA-State research shows.

ARS soil scientists W. E. Adams and M. Twersky, working in cooperation with the Georgia Agricultural Experiment Station, found winterkill of this grass was most severe where field plots had received a combination of high-nitrogen fertilization and low potassium over the past 3 years.

As the amounts of nitrogen increased, winterkill caused progressively more damage, particularly on plots that received no potash. Excessive nitrogen overstimulates the grass, making it more susceptible to winter injury. The potash counteracts this by hardening the plant.

Following a serious winter for plant damage in Georgia, stands of Coastal Bermudagrass in the spring of 1958 had been reduced by 8 to 65 percent, depending on the amounts and ratios of nitrogen and potassium applied during the preceding 3 years. Where no nitrogen had been applied, good stands were maintained regardless of the potash fertilization.

Soil tests showed that high-nitrogen fertilization was linked with depletion of soil potassium. Heavy applications of nitrogen resulted in rapid removal of potassium from the soil. This, in turn, increased winterkill of the Coastal Bermudagrass.

Clarkson, Popham advance

M. R. Clarkson, former Deputy Administrator for ARS regulatory programs, was recently named to a new post of Associate Administrator of ARS. He will share with Administrator B. T. Shaw the broad authority and responsibility for coordination of USDA research and administration of ARS research and regulatory work.

W. L. Popham, former Assistant Administrator for regulatory programs, moved into Clarkson's post.

Clarkson, born in Ferndale, Wash., received B.S. and D.V.M. degrees

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from Washington State College and an LL.B. degree from Georgetown University. He joined USDA in 1930 as veterinarian in meat inspection. Popham, born in Corvallis, Mont., received B.S. and honorary D.Sc. degrees from Montana State College. He joined USDA in 1922 in the barberry-eradication program.

Making better silage

Almost 10 percent more dry matter can be recovered in silage made from finely chopped and bruised forage than from coarsely cut forage.

In experiments as USDA's Agricultural Research Center, Beltsville, Md., bruised-forage silage also was more acidic than chopped-forage silage, and contained larger quantities of the desirable lactic acid. Butyric acid and ammoniacal nitrogen—both undesirable in silage—were lower in the bruised silage.

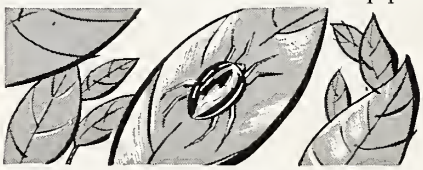
Scientists who made the tests feel the better quality silage produced by bruising was due to rupture of a high percentage of plant cells. This caused the fermentation to be more rapid and of a profoundly different nature than that occurring in coarsely chopped forage.

A way to curb mites

Mites on mature apple trees have been controlled experimentally by injecting systemic miticides into soil under the trees with a device designed by a USDA entomologist.

In trials in two Indiana orchards by M. L. Cleveland in cooperation with Purdue University, soil injection of Thimet, an organic phosphorus compound, effectively reduced mite populations without harm to any trees. Spraying Thimet on the trees, however, was somewhat more effective.

Cleveland's injector consists of a 4-foot piece of $\frac{3}{4}$-inch pipe into which is placed a 4-foot section of $\frac{1}{4}$-inch pipe. The two pipes are welded together, closed at one end, and that end shaped into a point through which a small hole is drilled to the inner pipe.



Water forced through this hole allows the injector to move into the ground readily.

Once the injector has been inserted about 3 feet deep, the miticide is forced through several holes in the outer pipe near the point. A Y-valve on the hose permits closing one pipe and opening the other.

Committeemen are named

Three new members have been appointed for 3-year terms to the Agricultural Research Policy Committee by Secretary of Agriculture Benson. They are Charles Marshall, Elmwood, Nebr., a wheat and livestock producer; Ken E. Geyer, Hartford, Conn., manager of the Connecticut Milk Producers Association; and Louis Ratzenberger, Hoopeston, Ill., president of the Illinois Canning Co.

The new committeemen replace Robert B. Taylor, Paul S. Willis, and the late Herbert W. Voorhees.

The committee, established under the Research and Marketing Act of 1946, advises USDA on research and service work policy.

Plant swap with Russia

We are again exchanging plant materials with Russia after a lapse of 15 years. Exchange was resumed at the urging of both American and Russian plant breeders.

International plant exchange was begun in 1898 by USDA's Plant Introduction Section. Over the years, trading plants has proved helpful to both countries because of their similarities in climate, agricultural interests, and crop problems. Our plant breeders received alfalfa and several important types of grass from Russia, while we gave the Russians sunflowers, which are now their major source of vegetable oil.

Recent shipments have included grasses, legumes, oilseeds, and small-grain and other cereal seeds. Tobacco and fruit breeding materials will also be exchanged this year.

Requests for foreign plant materials by U.S. research agencies and corresponding requests from abroad are cleared at USDA's Plant Industry Station, Beltsville, Md. In Russia, all seed exchange is through the All-Union Institute of Plant Industry.

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